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ABSTRACT

A pilot study was undertaken to investigate alternative inservice programs for teachers that would minimize their anxiety about computers and assist them in integrating computers into their teaching practices. The complete staffs of four elementary schools participated, and each school tested a different approach: math-drill and practice; math-higher level skills; language arts-drill and practice; and language arts-higher level skills. Emphasizing the use of software packages and hands-on experience, the 10 inservice sessions were delivered to the participants at each school separately for an hour at a time. The data, collected through pre- and post-training inventories, questionnaires, and interviews, revealed that teachers were generally receptive toward computers and their uses, and negative about feelings of anxiety, exposing ignorance when using computers, and of being unprepared and slow in relation to computers. It was also found that administrative leadership and support were very important factors in the success of the inservice program. Data summaries are presented in nine tables, copies of the forms and questionnaires used are appended, and references are provided. (DJR)

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An Investigation of Alternative Computer Inservice Programs for Elementary School Teachers

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July, 1986

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BACKGROUND

The impact of microcomputer technology on the education of public school children depends on the willingness of teachers to incorporate the technology into their teaching. But without appropriate training, teachers cannot be expected to accomplish this integration. Appropriate training programs must be designed with the following considerations in mind.

Research has indicated that there is a fairly high level of teacher concern about computers(Cicchili & Becker,1985). The concerns may be personal, for example, worrying about the ability to operate the machines. They may be practical such as wondering how to schedule student use of computers in the classroom. They may be philosophical concerns about the appropriate roles of computers in teaching.

Many teachers embark on computer training with some trepidation, indeed, for some, it may be a question of anxiety. Computer anxiety is viewed as a trait similar to test anxiety or math anxiety (Cambre & Cook, 1985) and is defined as a level of fear or apprehension felt by an individual either confronting, or thinking about confronting, a computer. It has been measured by a number of researchers and there seems little doubt but that it is frequently observed. Although this anxiety is not exclusive to teachers, teachers have been observed suffering from it effects(Rohner & Simonson).

In addition to the anxiety problem, there may be other reasons

teachers wish to avoid computer training. Wedman & Heller(1984) discuss several of these. One is the reluctance of an individual who has invested a great deal of time in learning to teach one way (without computers) to accept the burden of learning to teach in a new way. Another is the belief that there is no time available for both personal training on computers and the subsequent employment of computers in the classroom.

Compounding the problem of designing approriate training programs is the fact that very little research has been conducted in relation to inservice design for computer education (Wedman & Heller, 1984). There are many accounts of inservice projects (Burkholder,1985), but little empirical study. An exception is the study by Stecher(1984) with 25 secondary school teachers at each of eight different sites in California. Among his most important conclusions is a reaffirmation of the necessity of providing sufficient hardware and software and a significant amount of hands-on computer time in a situation with voluntary participants which focusses on the integration of computers into the instructional process. He also pointed out the importance of having trainers both competent in using the computers and knowledgeable about curricular uses of them.

But the researchers experienced difficulty in trying to adapt Stecher's work to their own inservice training program. Stecher's program was supported by a major computer manufacturer so that subsequent machine availability in the schools was much greater than would be the norm. This might make the inservice more attractive to teachers in the program than it would be to teachers who could not expect as much hardware available to them for instruction after the training. The emphasis on computer

applications during the training was on word processing, spreadsheets, and database packages. Many software packages more immediately related to the curriculum are available, but were not examined. Finally, the inservice was done over a 120 hour period in four weeks during the summer. It is no longer possible to ask large groups of teachers to give up their summers for such training.

It is clear, then, that alternative inservice strategies for assisting teachers to integrate the computer into the curriculum are needed and that these programs must be available for use in schools and school districts facing normal resource and monetary restrictions.

The researchers chose to begin with elementary school teachers for a variety of reasons. First, there is an argument that teachers in self-contained classrooms, as are most elementary school teachers, would have more flexibility in attempting to incorporate a new technology. Elementary school teachers teach more than one subject so it would be possible for them to test computer use in several topics if they deemed it appropriate.

Having decided to train teachers at the elementary level, the researchers took into account the fact that computers are used at that level primarily as aids in the instruction of other subjects (Anderson & Smith,1984; Becker,1983) . Because the two critical subjects in grades 1-6, regardless or program particulars, remain language arts and mathematics, it seemed reasonable to emphasize these two subject areas in computer inservice training.

The decision to work in language arts and math answered one question,

but raised another. Which of the two subject areas was the best starting place? There is an argument to introduce computer usage to teachers in mathematics before language arts for two reasons. First, the computer is more commonly used in mathematics than in other subjects (Anderson & Smith,1984) . This indicates that other teachers have found computers useful in math. Secondly, even the folklore relates computer thinking to math thinking.If teachers believe that computers belong with math, they may be more receptive to initiation to computer use in math.

But there is a counterargument to introduce computer usage to teachers in the language arts area first. There is a substantial body of evidence that many teachers experience mathematics anxiety (Rising,1978). Whereas teachers believe that they can do an effective job teaching language arts, they feel less adequate about teaching mathematics. In fact,Cambre & Cook (1985) report on a study by Raub linking math anxiety to computer anxiety. It would seem that less strain might be placed on the teacher by introducing the computer in an area where she is already more comfortable, viz.language arts.

There was still the question of deciding what type of software to emphasize in the math and language arts computer training .One could follow the drill and practice model of computer use in the elementary classroom or one could emphasize software designed to encourage more high level uses of the computer .

Using the computer primarily for drill and practice activities has potential. There is evidence that computer drill activity does improve achievement (Kulik,1985). This could be a very compelling argument to a

teacher for why the computer would be a valuable tool. As well, looking at the curriculum of the elementary school, there is a natural fit between drill and practice activity on the computer and the structure of the regular curriculum. Normal teaching activity emphasizes explanation and drill in both language arts and math. This fit between computers and program would have the benefit of reducing teacher anxiety about learning not just how to use the computer itself, but a new teaching style as well.

On the other hand, many have argued eloquently about the pointlessness of using computers to accomplish tasks which can be easily accomplished in other ways (Hill,1983). If the existing paper curriculum provides for a good deal of lower level skill teaching already, perhaps the computer can make its contribution best in helping teachers tackle new problems, problems they have had difficulty addressing before. Perhaps if the emphasis in training teachers to use computers is on software designed to develop higher level cognitive skills in pupils, teachers will feel that it is worth their time and effort to learn to use computers in their instruction.

With these factors in mind, the research question then becomes: Which is the best path to facilitate integration of computers into the teaching of the elementary school? Does one emphasize language arts or mathematics uses of computers? Does one emphasize software designed for drill and practice or software aimed at developing higher cognitive levels of thinking? Each of the four strategies, in its own way, attempts to minimize the problem of teacher anxiety about computers and improve teacher attitudes towards the computer.

PROCEDURES

The researchers embarked on a pilot study to examine the research questions, to assist in the development of appropriate data gathering tools, and to test training session strategies for future, larger-scale investigation.

A decision was made to provide inservice at the school level. Complete staffs of elementary schools, rather than individual teachers from a variety of schools, participated. This decision was made primarily on practical grounds. With only a small amount of hardware available to lend, it was essential that teachers in only a few physical locations be involved in the training. But to test for the effectiveness of the alternative strategies, large numbers of teachers were needed. Therefore, entire staffs, rather than individual volunteers, were used. It was decided that four schools would be required, one to test the math-drill and practice approach, one the math-higher level skills approach, one the language arts -drill and practice approach, and one the language arts-higher level skills aproach.

Contacts were made with all elementary school principals in the local school district through the cooperation of the district superintendency. Interested staffs were invited to participate in a ten session inservice program which was developed to train teachers to integrate the computer into their current teaching practices. An exhange was worked out.

Participating schools would receive two computers to be left in the school for most of the school year and teachers would be trained in hardware and software use. Each of the two language arts schools also received a printer. Most of the machines belonged to the university. Others were on loan from the provincial Department of Education. In return, the teachers were to complete reports indicating the nature of their computer usage in the school.

Of the four schools participating in this pilot experiment, two were quite small, with only 5 or 6 regular classroom teachers and the other two somewhat larger. In each school, the principal had talked to the staff about participating in the research and one or both of the researchers met with the staff to discuss the project . Individual teachers did not have a formal opportunity to opt out, although some in fact did, de facto.

Principals or principals and staffs together chose whether they were interested in the math treatment or the language arts one. Schools were assigned to the drill and practice or higher cognitive treatment based on an attempted fit with the attitudes and comments expressed by the staffs during the first two training sessions. It was decided from the start to emphasize the use of software packages and not to train teachers in computer programming;the exception was the teaching of a very minimal amount of LOGO programming to the teachers of the school assigned to the higher cognitive process/mathematics treatment.

To test the research question, it was decided to count frequency of use of the computer. However,the data collected also included information on the type of computer usage. Specific note was taken of the subject area

of the programs used, the level of thinking required of users, that is,whether the programs were drill and practice or required higher order thinking, the numbers of users, the sex and ability level of users, and the stated purpose of use.It was thought that this extra information about type of use might be helpful in examining the training alternatives. In addition, a pre-training and post-training attitude inventory were administered.

TRAINING SESSIONS

The inservice was delivered to each staff individually for an hour at a time during normal teacher planning time, usually once every second week. It is known that most computer inservice for teachers is in the form of 1 or 2 day workshops(Anderson & Smith,1984), but the researchers believed that an extended approach might be better for reducing anxiety and allowing teachers time to experiment with software in their classes when it was convenient.

Several sessions were held at the university computer lab to allow each teacher to have some hands-on experience with computers right away; others were held at the schools using the computers left at the schools . Each school received one Apple IIe computer and one IBM PC type computer, either a Corona portable or an IBM PCjr. Teachers of the two math schools experienced the same training sessions on the first two occasions, as did teachers of the two language arts schools.

At the first session, the researchers demonstrated a variety of the software packages available in either language arts or math, depending on assigned treatment. The teachers learned how to operate the computers and how to use a TV monitor with a computer to work with a whole class.There was an examination of the difference between drill and practice software and software aimed at developing higher cognitive processes as well.

At the second session, teachers received further practice in using the computer and were again shown how to link a TV to a computer. At this session, evaluation criteria for examining software were also discussed.

The third session, held in each school, centered around an examination of two software packages chosen by the researchers as potentially useful in that school's program. The software was demonstrated and the use of it in the curriculum was explicitly discussed. At this point in the training, only software appropriate to the assigned treatment condition was modelled.The software was then left in the schools to be tried out.

The fourth session at each school was devoted to a discussion about the problems the teachers were facing in using the computers and what might be done about these. In one of the schools, more discussion on this topic was required at the fifth session.

The fifth session in each school was scheduled so that very particular curricular concerns of the teachers could be dealt with. Each staff phoned before the training session describing the topics currently being taught in either language arts or mathematics, depending on treatment condition. This is consistent with Wedman's and Heller's(1984)

observation that adult participants in inservice must be allowed to be involved in the planning of the meetings.Sessions were tailored to demonstrate how particular pieces of software could be used to meet those needs. Each teacher or a pair of teachers sat at a machine with the software chosen to meet their expressed needs.

The last three sessions were run in the same way as was session number five. It was decided to cancel the last two sessions at each school when it became clear that the teachers were not enthusiastic about further formal meetings.

An informal session was held subsequent to the conclusion of the training period, at which time teachers were asked to complete a final attitude questionnaire. This final questionnaire incorporated all of the original questions and some others which, over the course of the study, emerged as potentially pertinent to predicting computer usage. Representatives of three of the four staffs attended the session. Other teachers who did not attend were asked to complete the forms back at their schools. Most did.

MEASURING INSTRUMENTS

At the first training session, all teachers were asked to complete a questionnaire to determine some initial information about themselves. This information included personal background data related to teaching experience, educational background and teaching style. It also included

measures of attitudes toward, knowledge of, and background experience with computers. The data was used to compare the level and nature of staff experience and background at the start of the study to determine how similar the groups were. It was also useful later to compare the patterns of computer usage of, for example, primary with upper elementary teachers, teachers with some computer background and those with none, and the like.

Two different attitude questionnaires were used in the study, as was a data collection form.

The initial attitude survey measured both computer knowledge and attitude. A copy of the complete survey is included as Appendix A. The first part consisted of 44 statements to be reacted to on a four point scale ranging from strong disagreement to strong agreement. Most items measured attitudes toward computers as related to public school instruction. But there were also measures of attitudes toward math versus language arts and aspects of teaching style, as these were deemed pertinent to explaining outcomes of the study.

The second part of the survey was a semantic differential on a six point scale using 20 pairs of opposite adjectives clustering around feelings of preparedness, confidence ,satisfaction and excitement about the use of computers. Teachers were asked to rate their perceptions of themselves as related to computers in terms of these adjectival descriptions.

In part three, a number of self-rating questions were asked regarding personality , typing skill,and interest and ability in learning languages, all seen as potentially related to computer ability and interest. Finally

a ten item test of computer knowledge was administered. It is valuable to know whether the attitudes expressed about computers are attitudes of people knowledgeable about them or unfamiliar with them.

Many of the items were borrowed from the survey produced by Wright and Stone(1983). This included most of the adjectives used in the semantic differential category and many of the items in the first part of the survey and the computer knowledge part of the survey. Much of the material for part three of the survey was borrowed from work by Toris(1984). There are a number of attitude measures available in the literature(Cambre & Cook,1985; Loyd & Gresard ,1985, Rohner & Simonson, 1981). Most were not specific enough to teachers or were not specific enough about various facets of concerns directly related to the research question to be used in this study.

A priori decisions were made to group items into categories to improve reliability. The categories from part one of the survey were : personal anxiety about computers, receptivity toward computer use , an attitude toward who would constitute the appropriate audience for the computer, concerns about the practical problems of using computers, an attitude about whether machines are useful in instruction, a concern about the dehumanizing effects of computers, and attitudes toward math versus language arts and teaching style.

Four categories relating to how the teachers saw themselves in terms of the computers were culled from part two. For analysis purposes, they were entitled : how fast the teacher felt, how prepared, how satisfied, and how excited.A description of which items contributed to each category

from parts one and two are listed in Appendix B.

The second questionnaire,completed in April, contained all of the statements in the first two parts of the earlier survey. In addition,further statements relating to teaching style and problems in using the computer were added. These additional statements, described in Appendix C, were included to deal with issues which, over the course of the study, had emerged as potentially predictive of computer usage.

The data form which was used to collect information on computer usage is found in Appendix D.

PROBLEMS ENCOUNTERED IN THE TRAINING

Contacts were maintained with the schools by visits and phone calls to the principals. But with the type of busy schedules elementary school teachers have, there were sometimes communication lapses.There were other problems as well.

It was clear after the first three sessions that many teachers were having difficulty in making the adjustment to using the computer in the classroom. Even though they had managed to use the computer themselves in the first two sessions, they needed more assistance in solving the problems which prevented them from following up the inservice. This was why a full training session was devoted to a discussion of these problems and possible solutions. Teachers' concerns centered around many of the problems which had been anticipated- fear of the machine, a concern for

time, and an uncertainty about exactly how to use the software to accomplish their curriculum goals.

It was apparent after session five that there would be some advantage to holding training sessions at the university lab rather than at the schools. In this way each teacher could work at his own machine at software more suited to his needs. One staff chose to continue working at the school. This meant that the software demonstrations were not always pertinent to all teachers at the session. On the other hand, when the lab was used and each teacher had her own package to examine, there were different problems. Sometimes these teachers felt frustration when they were forced to work on their own. This was especially true if some difficulty with the software was experienced since there were only one or two trainers available to help the whole staff. For some teachers, this became more than a minor obstacle, but a reason to feel disenchanted with the study. With adult learners, especially teachers, a trainer is often torn between the desire to give the learner room to learn in his own way and at his own rate and the advantages of a more highly structured, almost spoon-fed approach. This research tried to strike a balance, but leaned toward the side of self-instruction after the first three sessions. In retrospect, this may have been an error.

Other intervention was sometimes required. When teachers complained about not being able to individualize instruction or take small groups of students in to use the computer, steps were taken to provide hook-ups between the computers and the schools' television sets. These connections were installed by the researchers when it was clear that it might not

happen otherwise. When access to the machines became a problem, the teachers were led to develop schedules to facilitate housing of the computers in classrooms rather than far-removed equipment rooms. Time was taken to provide any suggested materials as quickly as possible. For example, in one school the French teachers expressed concern over a lack of software in the language required. One of the authors then wrote some programs which could be translated for these teachers. In fact, however, these never were translated.

A number of teachers did not fully participate in the training. Many missed one or two sessions and quite a few missed most sessions. Sometimes this was unavoidable, but in other cases, it was clear that the teachers had not been willing participants. Some teachers saw the training as an imposition on their time. They did not view the training as give and take with the researchers. In fact, they believed that they were giving, but not receiving. This was explicitly mentioned in comments by teachers. Perhaps a more formal sort of contract is needed to remind teacher participants of the role, responsibilities, and benefits for both themselves and the researchers.

It became very clear that teachers simply could not or did not take the time to complete forms each time that the computer was used. Indeed, the form provided is clearly too cumbersome for regular use, although something like this could be used occasionally to get additional information beyond the simple facts of who used the computer, which program was used , and for how long.

RESULTS AND CONCLUSIONS

The conclusions are discussed in a variety of categories. Separately analyzed are results on the initial and final attitude measures, attitude changes,and computer usage. Also explicitly examined are data comparing treatments , or schools, comparing teachers at different grade levels, and comparing computer users of various levels.

ATTITUDE SCALES

In Appendix B, with the initial attitude inventory categorization scheme , are found interitem correlations calculated to look at the actual relationships between items which were a priori considered to be related. This will allow for further refinement of these attitude measures in future work. Some of these correlations are examined by category in the ensuing paragraphs.

In the area of receptivity to computer use, it would appear that wanting to help students learn to use computers and believing that the school should have computers are highly related. Related to both of these is the belief that using computers would be enjoyable. There seems to be, though, no relationship between these attitudes of enjoyment and interest

and a belief that more computer training is necessary.

In the category of personal anxiety, a belief that computers make teachers uncomfortable seems unrelated to concerns about breaking the machinery, ruining software, typing skills, or exposing ignorance .

The researchers expected the category of practical problems to be an important one in examining teachers' concerns about using computers. One group of items seemed to reflect a general belief that teaching should be done to a full class, as oppposed to small groups, where all students work at the prescribed curriculum at the same time. There are high correlations between such items as "My students won't have time to learn regular subject matter and use the computer as well.", "I am afraid that when some students are using computers,others will have nothing to do.", and "Microcomputers are more trouble than they are worth.". Other items related to accessibility concerns.Those teachers who believed that computers would often be broken were often the same ones who believed that it would be hard to find a good location for computers.In other words, where accessibility problems were seen to be likely, many were expected to surface. There appeared to be no relationship between concerns related to software problems and those related to hardware.

It is interesting to observe that in the category of whether machines are useful in instruction, those teachers most likely to approve of the use of calculators at the elementary school level are the ones who believe that computers make life easier. Most elementary school teachers do not believe that the calculator should be used in math classes (Robitaille & O'Shea, 1985).

An analysis of the items grouped into the category relating to the potentially dehumanizing effects of computers shows that there was no significant relationship among the items. Therefore, this category was not used in analysis of the results of the training.

Data from the teaching style category is more difficult to understand than data from any of the other categories except for the dehumanizing effects of the computer category. The researchers expected a relationship between a problem solving approach to teaching, a willingness to deviate from the text series, and a belief that the teaching of basic skills in math need not be the single overriding curriculum principle guiding instruction in the subject. This relationship did not seem to exist in fact. Nevertheless,there was a sufficient relationship between other items in the category that it was decided that this category was a worthwhile one to analyze. One indication is that a belief in the priority of basic skill instruction in math does seem related to a demonstration-drill approach to teaching .

The four categories based on the semantic differential adjective scales were very cohesive. On this part of the survey teachers were asked to react to simple descriptions of themselves in response to computers as opposed to the more complex statements of part one. Perhaps it is easier to quickly categorize oneself as, for example, smart or dumb in relation to computers than to deal with the nuances of deciding, for example, whether one believes that computers restrict ways of thinking, where many conflicting situations might be imagined.

INITIAL ATTITUDES

The mean attitude scores for the various categores from the initial survey are shown in Table 1.Attitudes were most positive in the areas of receptivity to computer use, a belief that computers are useful to all students and in feelings of satisfaction with computers and excitement about their use. In particular, scores were high on items relating to:

1- the need for more computers in the school,
2- the need for more computer training,
3- a view of computers as a valuable resource,
4- the belief that computers are useful to all students,
5- a feeling of excitement,
6- a feeling of challenge,
7- a feeling of usefulness as applied to computers,
8- a feeling of happiness as applied to computers,
9- a feeling of interest,
10- a feeling of stimulation,
11- a feeling of entertainment.

It was verified, too, in this initial data that, indeed, teachers did have more positive attitudes toward teaching language arts than mathematics.

The overall low categories were in the measures of personal anxiety

about computers, acceptance of innovative teaching styles, and feelings of being prepared and fast in relation to computers. Specific indications of negative attitudes toward computers or innovative teaching were:

1- the view that computers are a threat to society,
2- a belief that basic skill work in language arts must precede any other alternative activities ,
3- a belief that students should not be allowed to use calculators often in math,
4- a fear of exposing ignorance when using computers,
5- a practice and drill approach to teaching,
6- a belief that computers make teachers uncomfortable,
7- a feeling of being unprepared in relation to computers,
8- a feeling of being slow in relation to computers,
9- a feeling of being weak in relation to computers.

BETWEEN SCHOOLS COMPARISON OF INITIAL ATTITUDES

A school by school analysis on the initial data is shown in Table 2. It is clear that the schools were not very dissimilar to start. Teachers in school 2 did appear to feel themselves more prepared and fast than the others and teachers in school 3 less satisfied and excited than the others.

FINAL ATTITUDES

The scores are shown in Table 3. Attitudes were most positive still in the areas most positive in the initial attitude measures- receptivity to computer use, a belief that computers are useful to all students, and feelings of satisfaction with computers and excitement about their use. In addition, there were now positive attitudes in the area of feeling prepared for computers. In particular, scores were high on items relating to:

1- the need for more computers in the school,
2- the belief that computers are useful to all students,
3- a view of computers as inevitable in schools,
4- a view of computers as a valuable resource,
5- a belief that computers generate excitement,
6- a belief that computers are a valuable addition to a school's resources,
7- a view that computers are not a threat to society,
8- a feeling of challenge related to computers,
9- a feeling of interest toward computers,
10- a lack of fear of computers,
11- a feeling of safety related to computers.

The most negative attitudes were in the areas of a view of machines as

useful in instruction ,an innovative teaching style, and a feeling of being fast in relation to the computer. Individual items where attitudes were negative toward computers or barriers to innovative teaching might be indicated were:

1- an unwillingness to allow students to use calculators often in math,
2- a belief that computer programs need to be in a game format ,
3- a belief that classroom routines are of great importance,
4- a belief that one does not learn faster using computers,
5- a belief that it is difficult to plan around computer use,
6- a belief that computers are not useful in whole class instruction,
7- a belief in practice and drill type teaching,
8- a belief that computers make teachers uncomfortable,
9- a belief that work cannot be accomplished faster using computers,
10- a belief that basic skills must be taught first,
11- a belief that there is not enough time to allow all students computer access,
12- and feelings of being slow, weak, and dumb in relation to computers.

There continued to be a preference for language arts instruction over math instruction.

BETWEEN SCHOOL COMPARISONS OF FINAL ATTITUDES

An analysis by school on the final data is shown in Table 4.

It can be noted that teachers in school 3 appeared to have the lowest attitude rankings on almost all categories. There were no rank changes among the staffs of the four schools in the areas of receptivity toward computer use, a concern about the practical problems of using the computer and a preference for math over language arts teaching. School 4 improved its rank in the area of anxiety and excitement about computers. School 1 improved its rank in the area of feeling prepared for computers and a willingness to adopt more innovative teaching styles . School 2 improved its relative ranking in an acceptance of the notion that the computer is useful to a broader range of pupils.

BETWEEN GRADES COMPARISONS OF FINAL ATTITUDES

An analysis by grade level on the final data is shown in Table 5. It does not appear possible to relate attitudes toward computers with grade level taught. It does appear, however, that math is more popular among upper elementary teachers than primary teachers.This is interesting to note in light of the fact that much greater use was made of language arts software than math software at the primary level.

ATTITUDE CHANGES

In Table 6 are listed the means and variances for the change scores in attitude data for the 31 teachers who wrote the questionnaire in both October and April. It is clear that many scores changed very little over the year, but other means increased by over one point on the four or six point scale.Very few attitudes became more negative and when they did, it was by very small amounts. The biggest positive changes were in items relating to :

1- the computer not being a threat to society,
2- feelings of being prepared, fast, satisfied, strong, secure, relaxed, comfortable, smart, confident, unafraid, controlling, and safe.

The only categories in which significant positive changes were noted were in the areas of being prepared and fast.

There were also somewhat smaller improvements in many of the other items on the semantic differential, as, for example, feelings of being young, useful, stimulated, happy, interested, and entertained. Too, one might note improvements in a concern about exposing ignorance when using the computer, a feeling that the computer was impersonal, a feeling that computers make teachers uncomfortable, and in the category of satisfaction as related to computers.

The negative changes, although minor,included items in the following areas:

1- a lessening of interest in learning more about computers,

2- a greater belief that students don't have time to use computers and complete other required work,

3- less belief that computers make life easier,

4- less belief that one can learn faster with computers,

5- a greater belief that software often does not work,

6- a greater belief that it is hard to find a good location for a school computer,

7- a lessening of the perceived need for more computer training.

It is interesting to speculate about the reasons for these negative changes. Perhaps the belief that less training is required or a lessening of interest in learning about computers makes sense once a significant training period has been completed. And, indeed, some of the practical problems like finding a good location for a single computer in a school or using software that didn't work on the first try do become more real with experience. Teachers who had to struggle to use the computer between sessions might indeed believe that computers don't make life easier or learning faster.

USER/NONUSER COMPARISONS

In Tables 7,8 and 9 are listed the means and variances for teachers categorized in five different groups on the basis of amount of computer use. Those in category 0 did not use the computer at all, as far as can be

determined, other than at the training sessions. Many did not even attend many sessions. Those in category 1 at least tried to use the computer. Those in category 2 made more use, but limited use, of the computer. Those in category 3 used the computer on a number of occasions and those in category 4 were the heaviest computer users. The decision as to which category pertained to a given teacher was made on the basis of reported computer use as well as informal discussions with the teacher and others in that teacher's school.

It is fair to report that heavier computer use was more likely if the teacher :

1- taught a higher grade level,
2- had a higher teaching certification,
3- was male,
4- had previously used a computer more frequently,
5- was initially less anxious about computers,
6- felt initially more prepared about computers,
7- felt initially more excited about computers,
8- initially knew more about computers.

At the end of the study, those heavier users still felt more receptive to computer use, less anxious and were more math oriented than lighter users.

COMPUTER USAGE

Shown in Table 10 are the results of the information obtained directly from the computer usage forms completed and returned by the participating teachers. As was mentioned earlier, many instances of use were unreported and this must be borne in mind when interpreting these results. However, if one assumes that these forms in some way sample computer use, one can make the following observations:

1- More use was made of the Apple than the IBM type machines.
2- More use of the computer was made by pupils than teachers.
3- Most pupil use was individual or small group rather than whole class use.
4- Most computer use was made during class time.
5- Mean time at the computer per session was about 30 minutes.
6- Most use of the computer was made during language arts or math periods.
7- Most use of the computer was made in the classroom.
8- Most teachers used only software which was dealt with in their training sessions.
9- About equal use was made of drill and practice software and higher cognitive level software.

There is no attempt to look at the type of users because so few data forms included the required information.

Of the 138 forms turned in, the distribution by school is shown in

Table 10. Also shown here are the percentage of teachers from each school who completed forms, and the number of forms per available teacher. It should be noted that there is some skew in the data for School 1 where one teacher turned in 34 forms. No one else came close. The data excluding the one teacher is shown in brackets.

THE MAJOR RESEARCH QUESTIONS

Because of the small numbers involved in the pilot and the difficulty in obtaining reliable computer use report data, it would be premature to make statements about the relative merits of the language arts or math approach. Clearly, though, it is a question worth pursuing. It cannot be overlooked that much more use was made of the computer in the languge arts schools than in the math schools at the primary level. It could be accidental, but is unlikely to be.

The drill and practice versus higher cognitive level question seems less fruitful to pursue. There were not any indications in the data that teachers were making this distinction when choosing software, although it must be admitted that at least in the math area, drill and practice software proved more attractive to the teachers involved than it did in the language arts area . It is likely, though, that this preference for drill and practice in math reflects on how closely the computer activity mimiced normal classroom activity. In math, drill and practice activity is the norm, whereas in language arts, there is more writing, which was

classified in the study as higher cognitive level process. The researchers are aware that this categorization of all writing at one cognitive level is very simplisitic and may lead to unfounded conclusions. It was not possible to be more precise, though, without observing the actual lessons involved. Perhaps expecting teachers to teach at a higher cognitive level, something out of the ordinary, at the same time they are being asked to use a new technology is simply too much to ask. Or perhaps the fact is that teachers have a drill oriented curriculum and simply cannot fit in nondrill activity easily.

The attitude results have been previously described.

TEACHER AND PRINCIPAL INTERVIEWS

The principal and two teachers at each of the four schools were interviewed at the conclusion of the study to try to address some of the questions still unanswered and to probe more deeply into the attitudes of the participants of the study.

Of the 12 people interviewed, only one had not used the computer at all,although several had used it only minimally. Most saw its use in the future in both language arts and math. When asked whether they intended to continue to use the computer next year, a number hoped to. But several felt that they could not, unless they had either smaller classes or much more machinery, for example, one computer for each two to three students.

Some teachers felt that anything less than 10 computers in a classroom was unworkable. Others,perhaps a little more realistic but still optimistic, felt 3 computers in a classroom would work. There were some who believed that sharing arrangements could work between two teachers in physically close classrooms with common interests.

There was mixed feeling about whether the computer worked best as a teaching tool for a teacher working with a group of children or as an interest centre outlet for individual or pairs of children. More teachers felt comfortable with the interest center approach, however, unless many more machines were made available to each school. In contrast,at least one teacher expressed concern about a single machine in a classroom becoming a reward center.

In choosing software, attractiveness and ease of use were mentioned as priority criteria more often than was content. Content was more important to some, however. No one type of software seemed to be most preferred by all. In fact, although a few mentioned word processing and a few mentioned drill and practice, most specifically stated that they had no preference.Many teachers felt that it would not matter to them if the text series they were using made specific reference to software which integrated with it and how, but others thought it would be helpful. Certainly, for many teachers, a Department of Education document outlining and requiring computer integration into the curriculum would make a difference.

The reasons why teachers wanted computers in the school varied. Although several mentioned that computers are part of the world and so

students should meet them to be prepared for future careers and life, others cited very different advantages. One teacher commented on how the computer could be used to provide independent experience for students.Several commented on its motivating value. One mentioned that it could save teachers time in the long run. Many felt that the integration of computers into the classroom would have to be at the cost of other material, although not all agreed. This perception clearly is a problem if teachers are to be encouraged to use the computer.

When asked about the biggest obstacle to computer use, the number of machines seemed to be the paramount problem to some teachers, whereas the concern about planning time and the continuing discomfort of teachers seemed the bigger problem to others. Some felt that the number of machines problem might be addressed in part by home and school type fundraising projects, but others felt that this was unlikely when shortages of inexpensive items like paper were already a problem.

What could be done to make computer usage an integral part of the school program? The answers varied considerably. Where some thought it was an individual effort on the part of individual teachers, others believed that a united front was required. Several teachers mentioned the importance of a real commitment on the part of the administration of the school and perceived teacher leaders in the school. One teacher mentioned the need for a centralized software bank easily accessible to teachers.

A number of questions were also asked about the training sessions themselves. All agreed that after school sessions were out of the question. A number of teachers felt that the Wednesday afternoon planning

time slot was best, but many resented that imposition on their time. They felt that professional development days would be better, or, better still, would be release time where the District approves supply teachers to free participants. This, they believed, would make it easier for them to give full attention to the training and would provide added credibility to the project. Most felt that the size of the group at a session should not exceed ten and should, in fact, be smaller.

One interesting quetion revolved around whether it is best to train a staff together or whether a number of teachers from the same grade level at different schools would make a better training group. Again, there was divided opinion. After talking to all twelve, however, it appears that initial training in how to use computers within a staff, followed by an interchange of curricular specifics among teachers of the same grade level, might be ideal. From the point of view of the principals, there appeared to be some benefit to working with a whole staff, although individuals may not have wished to participate. Most teachers, however, and the researchers now believe that working with strictly volunteers , whether members of the same staff or not,might be better at this stage of computer development in the system.

When asked how the training sessions might be improved, teachers provided conflicting ideas. Where some felt short regularly spaced sessions would be best, others felt that longer, but more intensive training was needed. One mentioned the need for the researchers modeling computer use with youngsters, while another specifically suggested that modeling might be intimidating. Most felt that more hands-on experience

working alone,not even with a partner, at the computer was necessary. They also felt the need for more hand-holding. One teacher suggested the involvement in the session of a teacher in the system who had had successful computer experiences to report. One teacher felt the need for a more detailed written outline of commitments and goals .

So as to more closely simulate likely computer implementation conditions, the researchers did not visit the schools between sessions very often unless specifically asked. However, several teachers mentioned the possible advantages that could have accrued had the researchers been more visible and,therefore, available for informal contact. It was observed that regular appearances might also have served as reminders to participants to try software out.

When asked to describe the sources of frustration that some of the participants felt in working with computers, the most common remark related to a lack of time . Cited were the many other problems with which these teachers were forced to deal, including repeatedly altered timetables, a lack of enthusiasm for new and difficult tasks, and the inability of the researchers to always address problems specific to the grade level of an individual participant during a training session.

Most teachers believe that computers will become part of the normal educational milieu, but not everyone does. Many believe that unless computer work becomes part of prescribed curriculum and more machines are made available, computers will remain expensive and minimal add-ons only for those who are especially keen.

INFORMAL OBSERVATIONS AND FEEDBACK

It is clear that change is a slow process. Perhaps it cannot be expected that teachers with many things on their plate would be able,even over the course of a year, to come to grips with a new technology. The fact that most teachers feel somewhat more comfortable with the machines by the end of the training is good. It probably indicates that the next time they are exposed to computers, more and faster progress can be made.

It was disappointing that teachers did not attempt to utilize the resource people available more than they did. Although many teachers might have felt awkward about imposing on the researchers and were, therefore, reluctant to call for help, there may have been other factors at work. Perhaps the teachers were simply too worried about asking what they feared might be foolish questions. Even though they were invited many times to ask anything and not be embarrassed, they found this difficult. This points to the need for resource people who are frequently around, almost part of the furniture. This sort of resource person might be less intimidating. Perhaps, too, teachers really are not given enough experience in seeking their own resources. They are provided with a packaged program and asked to deliver it. Then, when interesting alternatives or supplements come along, they have not had sufficient practice in learning to integrate these extras.

The importance of administrative leadership and support for the success of the program of inservice in the school cannot be

underestimated.In all four schools, the principals were anxious to be involved in the project and work toward its success. But in the schools where the principals seemed to the researchers to have shown the most involvement in the training themselves , a greater percentage of the staff became seriously involved in the project. This is consistent with Marion's(1984) observation that teacher interest patterns were strongly related to positive behavior on the part of the principal.Similarly, the emerging leadership of one or two teachers to guide and motivate others on staff has been an important variable in general involvement of the staff.

RECOMMENDATIONS

1. More research must be done into the best procedures for inservice training with respect to computers. In addition to the mathematics versus language arts question, there are questions about whether involvement should be voluntary, and what kind of accompanying support is required.
2. Centrally developed materials indicating what software supports the existing curricula and how it could be used is vital. This type of development must show instructional use as well as interest centre use of computers.This could be accomplished by pooling the resources of provincial and district personnel with teachers and researchers.
   It is much to be preferred to have the educational community developing guidelines for using computers in instruction before they are forced by

outside demands for computer availability in the schools into a more haphazard approach.

3. More Apple and MS DOS machines must be made available with a goal of at least one computer in each classroom. Home and school association fundraising, district budget allocations, and direct parental support might be combined to make this possible.
4. The district and/or province must provide further support in the form of consultative services to interested teachers.
5. School administrators must model computer use and encourage teachers who are reluctant if computers are to be used to their potential in public school education.

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TABLES

Initial Attitude Data

Category	Mean		Variance	N
Receptivity	3.39	(out of 4)	.5	35
Personal Anxiety	2.61		.61	35
Audience	3.27		.65	35
Practical Problems	3.03		.49	35
Machines as Useful	2.79		.56	35
Math versus Language	2.33		.60	35
Teaching Style	2.50		.39	35
Prepared	2.77	(out of 6)	1.09	35
Fast	2.72		.94	34
Satisfied	3.72		1.08	35
Excited	4.0		1.27	35

Table 1

School by School Analysis of
Background and Initial Attitude Data

Category	School 1	School 2	School 3	School 4
Years teaching	16.67	16.86	17.71	15.6
	(7.26)	(7.95)	(9.71)	(4.51)
Years at current level	10.44	7.43	7	8.4
	(7.58)	(7.52)	(4.82)	(6.11)
Teaching certification	3.56	4	4.07	3.4
	(1.59)	(1.15)	(1.44)	(2.41)
Age	40.33	42.14	37.64	40.2
	(9.82)	(8.51)	(15.72)	(8.14)
Frequency of computer use	1.56	1.71	1.93	1.2
	(.73)	(.76)	(1.0)	(.45)
Receptivity	3.50	3.36	3.23	3.7
	(.30)	(.54)	(.60)	(.27)
Personal Anxiety	2.54	2.77	2.53	2.73
	(.56)	(.74)	(.47)	(.94)
Audience	3.48	3.24	3.02	3.6
	(.41)	(.57)	(.79)	(.55)
Practical Problems	3.00	3.11	2.93	3.21
	(.20)	(.65)	(.49)	(.70)
Machines as Useful	2.69	2.95	2.74	2.87
	(.35)	(.71)	(.66)	(.41)
Math versus Language	2.41	2.24	2.42	2.07
	(.43)	(.83)	(.59)	(.64)
Teaching Style	2.38	2.63	2.49	2.54
	(.35)	(.35)	(.47)	(.26)
Prepared	2.69	3.55	2.4	2.87
	(1.0)	(1.0)	(.99)	(1.26)
Fast	2.82	3.44	2.46	2.3
	(.79)	(.92)	(.94)	(.83)
Satisfied	4.25	4.18	3.2	3.6
	(.83)	(.93)	(1.0)	(1.4)
Excited	4.48	4.43	3.6	3.73
	(.75)	(1.05)	(1.51)	(1.38)
Correct on Computer Knowledge	3.78	3.71	3.93	3.4
	(2.11)	(2.14)	(2.67)	(2.3)
Math Ability	4.22	4.71	4.07	3.2
	(.97)	(1.11)	(1.0)	(1.48)

Math Attitude	4.78	5.28	4.57	3.6
	(1.20)	(1.11)	(1.02)	(1.34)
Foreign Language	3.67	2.86	4.29	3.2
Ability	(1.58)	(1.46)	(1.14)	(1.79)
Foreign Language	4.11	3.43	4.62	3.4
Attitude	(1.45)	(1.27)	(1.56)	(1.67)
Language Arts	4.11	4.14	4.14	4.2
Ability	(1.05)	(1.34)	(1.29)	(1.10)
Language Arts	4.89	4.71	4.64	5.2
Attitude	(1.05)	(1.11)	(1.08)	(.84)

Table 2

Final Attitude Data

Category	Mean	Variance	N
Receptivity	3.29(out of 4)	.45	31
Personal Anxiety	3.05	.52	31
Audience	3.37	.56	31
Practical Problems	3.04	.31	31
Machines as Useful	2.78	.37	31
Math versus Language	2.27	.72	31
Teaching Style	2.65	.32	31
Prepared	4.14(out of 6)	.94	31
Fast	3.8	.81	31
Satisfied	4.44	.96	31
Excited	4.47	.96	31

Table 3

Comparisons in Final Attitude Data by School

Category	School 1	School 2	School 3	School 4
Receptivity	3.36	3.38	3.1	3.56
	(.31)	(.38)	(.52)	(.52)
Personal Anxiety	3.13	3.11	2.93	3.15
	(.48)	(.43)	(.57)	(.66)
Audience	3.37	3.78	3.11	3.5
	(.51)	(.40)	(.61)	(.43)
Practical Problems	3.07	3.07	2.92	3.29
	(.29)	(.29)	(.33)	(.24)
Machines as Useful	2.81	2.83	2.75	2.76
	(.46)	(.3)	(.38)	(.32)
Teaching Style	2.74	2.77	2.53	2.65
	(.38)	(.39)	(.27)	(.19)
Prepared	4.57	4.28	3.71	4.29
	(.65)	(.89)	(1.1)	(.77)
Fast	4.22	4.08	3.48	3.88
	(.57)	(.7)	(.92)	(.86)
Satisfied	4.81)	4.71	3.94	4.75
	(.66)	(.77)	(1.22)	(0)
Excited	4.67	4.72	3.94	5.25
	(.75)	(.44)	(1.18)	(.32)

Table 4

Comparisons in Final Attitude Data by Grade Taught

	Grade					
Category	1	2	3	4	5	6
Receptivity	3.15	3.25	3.25	3.56	2.96	3.67
	(.34)	(.31)	(.29)	(.43)	(.6)	(.34)
Personal Anxiety	3.6	3.16	2.9	2.47	2.93	3.17
	(.32)	(.48)	(.38)	(.4)	(.3)	(.64)
Audience	3.33	3.47	3.5	3.5	3.11	3.39
	(.41)	(.45)	(.58)	(.64)	(.8)	(.61)
Practical Problems	3.24	2.88	3.15	3.15	2.81	3.14
	(.34)	(.26)	(.06)	(.21)	(.36)	(.3)
Machines as Useful	2.85	2.67	2.83	2.96	2.78	2.81
	(.34)	(.31)	(.14)	(.25)	(.47)	(.46)
Math vs Lang	1.93	1.8	2.42	2.58	2.44	2.69
	(.55)	(.87)	(.17)	(.69)	(.54)	(.79)
Teaching Style	2.76	2.68	2.82	2.59	2.47	2.56
	(.3)	(.36)	(.4)	(.39)	(.24)	(.21)
Prepared	4.47	4.57	4.12	3.75	3.92	4.17
	(1.13)	(.4)	(.37)	(1.37)	(1.26)	(.89)
Fast	4.31	4.2	3.83	3.38	3.78	3.77
	(.59)	(.36)	(.67)	(1.23)	(1.11)	(.7)
Satisfied	4.4	4.7	4.5	4.25	4.04	4.8
	(1.32)	(.54)	(.46)	(1.54)	(1.3)	(.51)
Excited	4.6	4.73	4.33	4.42	3.89	5.06
	(.55)	(.72)	(.27)	(1.62)	(1.13)	(.88)

Table 5

Changes in Attitude

Category	Mean	Variance	N
Receptivity	-.08	.56	31
Personal Anxiety	.43	.77	31
Audience	.11	.80	31
Practical Problems	.01	.57	31
Machines as Useful	-.01	.67	31
Math versus Language	.01	.88	31
Teaching Style	.12	.48	31
Prepared	1.38	1.6	31
Fast	1.16	1.24	31
Satisfied	.74	1.23	31
Excited	.45	1.56	31

Table 6

Comparisons in Background between Lighter and Heavier Users

Type of User (from 0 to least to 4 for most)

Category	0	1	2	3	4
Number in category	6	10	9	3	7
Grade Level	3.33 (2.07)	3.6 (1.9)	2.75 (1.67)	4.67 (1.53)	4.29 (2.06)
Years Teaching	23.5 (6.69)	15.2 (7.6)	16.89 (6.72)	24.67 (5.03)	10.71 (6.21)
Years Teaching at Current Grade Level	7.67 (5.68)	8.4 (4.79)	10.44 (7.73)	15 (7.07)	4.57 (4.58)
Teaching Certification	3.33 (1.21)	3.78 (1.09)	4.13 (1.46)	4 (1.73)	5 (.58)
Age	49.33 (8.82)	36.56 (7.35)	41.89 (9.87)	49 (5)	33.869 (7.93)
Sex(1 is male)	2 (0)	2 (0)	2 (0)	1.67 (.58)	1.57 (.53)
Prior frequency of computer use	1.67 (1.03)	1.5 (.71)	1.56 (.53)	1.67 (.58)	2.14 (1.21)
Prior computer competence	1.17 (.41)	1 (0)	1 (0)	1.33 (.58)	1.29 (.49)

Table 7

Comparisons in Initial Attitude Data between
Heavier and Lighter Computer Users

Type of User (from 0 to least to 4 for most)

Category	0	1	2	3	4
Receptivity	2.94	3.35	3.54	3.67	3.54
	(.65)	(.44)	(.49)	(.38)	(.3)
Personal	2.24	2.53	2.49	3.07	3
Anxiety	(.46)	(.66)	(.71)	(.12)	(.37)
Audience	2.94	3.17	3.48	3.44	3.33
	(.5)	(.71)	(.63)	(.19)	(.54)
Practical	3.22	2.81	3.13	2.93	3.07
Problems	(.57)	(.49)	(.37)	(.79)	(.47)
Machines as	2.86	2.64	2.84	2.94	2.79
Useful	(.99)	(.46)	(.42)	(.51)	(.52)
Math versus	2.14	2.38	2.13	2.67	2.52
Language	(.64)	(.4)	(.68)	(1.15)	(.47)
Teaching Style	2.48	2.37	2.67	2.33	2.54
	(.45)	(.34)	(.42)	(.23	(.41)
Prepared	2.44	2.45	2.46	4.33	3.24
	(1.57)	(.74)	(.65)	(.44)	(1.15)
Fast	2.39	2.52	2.59	4.06	2.88
	(1.68)	(.47)	(.54)	(.35)	(.8)
Satisfied	3.29	3.63	3.58	4.92	3.89
	(1.37)	(1.12)	(.95)	(.38)	(.98)
Excited	3.17	3.7	3.96	5	4.81
	(1.59)	(1.05)	(1.12)	(0)	(1.23)
Correct on	2.5	2.8	4	5	5.43
Knowledge Test	(1.76)	(1.81)	(.87)	(2.65)	(3.41)

Table 8

Comparisons in Final Attitude Data between Heavier and Lighter Computer Users

	Type of User (from 0 for least to 4 for most)				
Category	0	1	2	3	4
Number in category	3	9	9	3	7
Receptivity	2.83	3.14	3.22	3.67	3.61
	(.76)	(.4)	(.29)	(.29)	(.35)
Personal Anxiety	2.33	3.2	2.81	3.13	3.46
	(.31)	(.35)	(.51)	(.31)	(.43)
Audience	2.88	3.22	3.33	3.89	3.57
	(.69)	(.65)	(.41)	(.19)	(.53)
Practical Problems	2.95	2.8	3.07	3.28	3.25
	(.35)	(.25)	(.39)	(.01)	(.33)
Machines as Useful	2.94	2.68	2.6	2.94	3.02
	(.1)	(.28)	(.34)	(.51)	(.42)
Teaching Style	2.33	2.56	2.75	2.87	2.69
	(.42)	(.32)	(.22)	(.50)	(.28)
Prepared	2.56	4	4.5	4.44	4.43
	(.96)	(.79)	(.57)	(1.08)	(.92)
Fast	2.28	3.9	4.13	4.06	4.05
	(.48)	(.48)	(.56)	(1)	(.85)
Satisfied	3.0	4.08	4.67	5.08	4.96
	(1.773)	(.97)	(.47)	(.38)	(.47)
Excited	2.78	4.37	4.63	4.78	5.0
	(1.35)	(.77)	(.72)	(.38)	(.77)

Table 9

Reported Computer Usage

Number of Forms by School

School 1	69(35 if one teacher is excluded)
School 2	26
School 3	59
School 4	25

Percentage of Teacher Involvement by School

School 1	81%
School 2	71%
School 3	67%
School 4	80%

Number of Forms Turned in by Individual Teachers

Number of Forms	Number of Teachers
0	11
1	3
2	7
3-5	7
6-10	6
11-20	4
20-	1

Machines Used

Apple	130
IBM	39
Other	6

Machine User

Teacher	55
Pupils	122

Size of User Group

Whole Class	48
Individual or Pair	80

When Used

Class time	103
Other	67

Mean Length of Use

For teachers	37.45 minutes
For pupils	35.74 minutes

Subject Taught while Computer was Used

Math	53
Language Arts	65
Other	7

Location of Use

Classroom	118
Resource Room	40
Other	22

Subject of Program

Math	74 (14 from language arts schools;64 from math schools)
Language Arts	77 (9 from math schools;68 from language arts schools)
Other	20

Cognitive Level of Software Used

Drill and Practice Math	36
Drill and Practice Language Arts	29
Other Drill and Practice	12
Higher Level Math	34
Higher Level Language Arts	42

Table 10

Appendix A

ID Number___

Background Data

Please note your ID number. It will be used throughout the study to preserve your anonymity.

Teaching experience

Number of years taught _____
Present grade level taught _____
Number of years at that level _____
Indicate whether you teach in English or French _____

Personal Background

Highest teaching certificate _____
Highest degree (if applicable)_____
Institutions(s) of educational training _____
_____
Age _____
Sex _____
Number of half courses in language arts _____
Number of half courses in math/math education _____
Year of most recent language arts course _____
Year of most recent math course _____

Microcomputer Background- Check appropriate category(or categories) in each column.

Frequency of current use	Competence	Access
____ None	____Beginner	____ None
____ Seldom	____Some	____ School
____ Weekly	____A lot	____ Home
____ Daily	____Very able	____ Elsewhere

For each of the subjects:language arts, math, social studies, science, health, art, music and physical education, indicate the group sizes which you regularly use.

Subjects

small group teaching (2-10/group): _____

whole group teaching: _____

individualization (for some students): _____

Part I

For each item below, circle the number on the right which best represents your own attitude toward the statement.

	Disagree		Agree	
	strongly	somewhat	somewhat	strongly
1. I want to learn more about microcomputers .	1	2	3	4
2. I would like helping students to learn to use microcomputers .	1	2	3	4
3. Our school needs more microcomputers.	1	2	3	4
4. Microcomputers are too impersonal.	1	2	3	4
5. Everyone should learn how to use microcomputers .	1	2	3	4
6. I am afraid I will break the microcomputers or ruin the programs.	1	2	3	4
7. Microcomputers are useful only to above-average students.	1	2	3	4
8. My students won't have time to learn regular subject matter and use the microcomputers as well.	1	2	3	4
9. Elementary students should be permitted to use calculators often.	1	2	3	4
10. Microcomputers make life easier.	1	2	3	4
11. I am afraid I will expose my ignorance when using microcomputers .	1	2	3	4
12. Microcomputer use in education is inevitable.	1	2	3	4
13. Microcomputers will probably be too hard to get at .	1	2	3	4
14. Microcomputers are mostly for students.	1	2	3	4
15. I prefer teaching mathematics to language arts.	1	2	3	4
16. I am afraid that when some students are using microcomputers , others will have nothing to do.	1	2	3	4
17. Microcomputers are more trouble than they are worth.	1	2	3	4

18. Microcomputers should be used only when they are available to everyone in the class.	1	2	3	4
19. You can learn faster using microcomputers .	1	2	3	4
20. Microcomputers will take over many teaching functions.	1	2	3	4
21. I believe that too much time is spent on frills in language arts.	1	2	3	4
22. Microcomputer software is often impossible to use.	1	2	3	4
23. I would enjoy using microcomputers .	1	2	3	4
24. I am worred about using the microcomputer because my typing skills are poor.	1	2	3	4
25.Microcomputers are too abstract for young children.	1	2	3	4
26. I am more insecure about teaching language arts than mathematics.	1	2	3	4
27. Microcomputers are too complicated to be useful.	1	2	3	4
28. It will probably be hard to find a good location for our microcomputers .	1	2	3	4
29. Microcomputers restrict children to a limited way of thinking.	1	2	3	4
30. For the most part, I teach by telling, then demonstrating, then practicing new material.	1	2	3	4
31. Microcomputers make teachers uncomfortable.	1	2	3	4
32. I will be able to do my work faster with microcomputers .	1	2	3	4
33.Microcomputers generate excitement.	1	2	3	4
34. Software is usually easy to use.	1	2	3	4
35. We need more microcomputer training at school.	1	2	3	4
36. Children need to learn basic skills before other content in math.	1	2	3	4
37. Microcomputers are more of a toy than a tool.	1	2	3	4
38. Microcomputers are often unavailable because they are broken.	1	2	3	4
39. Microcomputers are a valuable addition to school resources.	1	2	3	4
40. Microcomputers promote social	1	2	3	4

interaction.				
41. For the most part, I teach by posing problems and questioning.	1	2	3	4
42. Microcomputers are a threat to society.	1	2	3	4
43. I often deviate from the approved textbooks and courses of study.	1	2	3	4
44. Microcomputers will be most helpful in math classes.	1	2	3	4

Part II

On each line below, mark a number from 1 to 6 which best reflects your own feeling about yourself in relation to microcomputers . Note that each line expresses a continuum about one attribute. For example, the scale one to six used below on the first line expresses ratings from 1-"very unprepared" to 6-"very prepared". The next scale expresses ratings from 1-"very slow" to 6-"very fast".

Very	Somewhat	Minimally	Minimally	Somewhat	Very
1 unprepared	2	3	4	5	6 prepared
1 slow	2	3	4	5	6 fast
1 frustrated	2	3	4	5	6 satisfied
1 weak	2	3	4	5	6 strong
1 insecure	2	3	4	5	6 secure
1 tense	2	3	4	5	6 relaxed
1 uncomfortable	2	3	4	5	6 comfortable
1 dumb	2	3	4	5	6 smart
1 worried	2	3	4	5	6 confident
1 old	2	3	4	5	6 young
1 unenthusiastic	2	3	4	5	6 excited

1	2	3	4	5	6
bored					challenged
1	2	3	4	5	6
useless					useful
1	2	3	4	5	6
unaffected					stimulated
1	2	3	4	5	6
sad					happy
1	2	3	4	5	6
disinterested					interested
1	2	3	4	5	6
frightened					unafraid
1	2	3	4	5	6
intimidated					controlling
1	2	3	4	5	6
threatened					safe
1	2	3	4	5	6
tired					entertained

Part III

Circle the appropriate number from 1 to 6 on each scale to describe yourself.

1. your math ability

1	2	3	4	5	6
very poor					very good

2. your attitude toward math

1	2	3	4	5	6
very poor					very good

3. your ability to learn languages

1	2	3	4	5	6
very poor					very good

4. your attitude to having to learn another language

1	2	3	4	5	6
very annoyed					very pleased

5. your personality

1	2	3	4	5	6
very shy					very outgoing

6. your typing skill

1	2	3	4	5	6
very poor					very good

7. your ability in English language and literature

1	2	3	4	5	6
very poor					very good

8. your attitude toward English language and literature

1	2	3	4	5	6
very poor					very good

Part IV

For each sentence below, indicate whether it is true(T),false(F), or whether you don't know(DK).

T F DK 1. A microprocessor is part of a home computer.
T F DK 2. Fortran, Basic and Pascal are computer programming languages.
T F DK 3. Word processing means using a computer as typewriter.
T F DK 4. Software refers to the pliable silicon components inside a computer.
T F DK 5. Online refers to the time the computer is not working because of equipment problems.
T F DK 6. Computer materials are interchangeable among machines.
T F DK 7. Spreadsheets refer to the punch-holed computer paper used in the printer.
T F DK 8. Writing computer programs is called debugging.
T F DK 9. Authoring languages allow nonexperts to write their own programs.
T F DK 10. Most home computers can be programmed in several languages.

Appendix B

Category- Receptivity toward Computers

Item Numbers- 1,2,23,35

Interitem Correlations for the Category

Item	1	2	23	35
1	1.0	.61	.47	.17
2		1.0	.55	0
23			1.0	.56
35				1.0

Category- Personal Anxiety

Item Numbers- 6*,11*,14*,24*,31* (*indicate that the score was reversed so that a higher value indicates a more positive attitude to computers or innovation)

Interitem Correlations for the Category

Item	6	11	14	24	31
6	1.0	.54	.37	.15	0
11		1.0	.12	.43	0
14			1.0	.25	.23
24				1.0	0
31					1.0

Category- Audience

Item Numbers- 5,7,25

Interitem Correlations for the Category

Item	5	7	25
5	1.0	.13	.36
7		1.0	.31
25			1.0

Category- Practical Problems

Item Numbers- 3,8*,13*,16*,17*,18*,22*,28*,34,38*

Interitem Correlations for the Category

Item	3	8	13	16	17	18	22	28	34	38
3	1.0	.24	-.13	0	.24	.45	-.10	.15	0	.26
8		1.0	.19	.57	.58	.34	.45	.19	.43	.17
13			1.0	.3	.22	0	.17	.26	.45	.13
16				1.0	.33	.55	.34	.23	.52	.30
17					1.0	.38	.34	.19	.51	.29
18						1.0	.27	.30	.24	.48
22							1.0	0	.57	0
28								1.0	-.21	.79
34									1.0	-.29
38										1.0

Category- Dehumanizing Effects of the Computer

Item Numbers- 4*,20*,29*,40,42*

Interitem Correlations for the Category

Item	4	20	29	40	42
4	1.0	.12	.18	-.22	-.47
20		1.0	.07	-.18	-.55
29			1.0	.19	-.31
40				1.0	.29
42					1.0

Category- Machines as Useful

Item Numbers- 9,10,19,27*,32,37*

Interitem Correlations for the Category

Item	9	10	19	27	32	37
9	1.0	.34	.24	0	.15	.26
10		1.0	.4	.34	.45	.42
19			1.0	.19	.58	.27
27				1.0	.4	.53
32					1.0	.55

Category- Math versus Language Arts

Item Numbers- 15,26,44 (A higher score indicates a preference for math.)

Interitem Correlations for the Category

Item	15	26	44
15	1.0	.25	-.22
26		1.0	0
44			1.0

Category- Teaching Style

Item Numbers- 21*,30*,36*,41,43

Interitem Correlations for the Category

Item	21	30	36	41	43
21	1.0	.15	.02	.11	.12
30		1.0	.4	.13	.1
36			1.0	0	0
41				1.0	0
43					1.0

Category- Prepared

Items Involved-Prepared,Secure,Relaxed,Comfortable,Unafraid,Safe

Interitem Correlations for the Category

Item	P	Se	R	C	U	Sa
P	1.0	.66	.46	.69	.31	.34
Se		1.0	.68	.78	.56	.57
R			1.0	.83	.67	.57
C				1.0	.71	.58
U					1.0	.75
Sa						1.0

Category- Fast

Items Involved- Fast,Strong,Smart,Confident,Young,Controlling

Interitem Correlations for the Category

Item	F	St	Sm	Cf	Y	Ct
F	1.0	.49	.56	.46	.15	.35
St		1.0	.74	.52	.25	.49
Sm			1.0	.69	.21	.53
Cf				1.0	.43	.66
Y					1.0	.24
Ct						1.0

Category- Satisfied

Items Involved- Satisfied,Happy,Entertained,Interested

Interitem Correlations for the Category-

Item	S	H	E	I
S	1.0	.26	.22	.36
H		1.0	.83	.78
E			1.0	.53
I				1.0

Category- Excited

Items Involved- Excited, Challenged, Stimulated

Interitem Correlations for the Category-

Item	E	C	S
E	1.0	.8	.7
C		1.0	.75
S			1.0

Appendix C

Shown is the final questionnaire in its entirety.

Part I

For each item below, circle the number on the right which best represents your own attitude toward the statement.

	Disagree		Agree	
	strongly	somewhat	somewhat	strongly
1.I want to learn more about microcomputers.	1	2	3	4
2.I would like helping students to learn to use microcomputers.	1	2	3	4
3.Our school needs more microcomputers.	1	2	3	4
4.I frequently use novel ideas to motivate students .	1	2	3	4
5.Microcomputers are too impersonal.	1	2	3	4
6.Everyone should learn how to use microcomputers.	1	2	3	4
7.I am afraid I will break the microcomputers or ruin the programs when I use them.	1	2	3	4
8.Microcomputers are useful only to above-average students.	1	2	3	4
9.My students won't have time to learn regular subject matter and use the microcomputers as well.	1	2	3	4
10.Elementary students should be permitted to use calculators often.	1	2	3	4
11.Microcomputers make life easier.	1	2	3	4
12.Computer programs should be in a game format.	1	2	3	4
13.Students can use microcomputers more easily individually and in small groups than as a whole class.	1	2	3	4
14.I am afraid I will expose my ignorance when using microcomputers.	1	2	3	4

15.I work hard to establish classroom routines.	1	2	3	4
16.Microcomputer use in education is inevitable.	1	2	3	4
17.Microcomputers will probably be too hard to get at.	1	2	3	4
18.Microcomputers are mostly for students.	1	2	3	4
19.I prefer teaching mathematics to teaching language arts.	1	2	3	4
20.I am afraid that when some students are using microcomputers , others will have nothing to do.	1	2	3	4
21.Microcomputers are more trouble than they are worth.	1	2	3	4
22.Microcomputers should be used only when they are available to everyone in the class.	1	2	3	4
23.You can learn faster using microcomputers.	1	2	3	4
24.Microcomputers will take over many teaching functions.	1	2	3	4
25.I believe that too much time is spent on frills in language arts.	1	2	3	4
26.I find computers difficult to use because it is neccesary to plan their use too far in advance.	1	2	3	4
27.Microcomputer software is often impossible to use.	1	2	3	4
28.I would (or do)enjoy using microcomputers.	1	2	3	4

4[illegible] Children need to learn basic skills before other content in math.	1	2	3	4
47. Microcomputers are more of a toy than a tool.	1	2	3	4
4[illegible] I really enjoy learning new things.	1	2	3	4
49. Microcomputers are often unavailable because they are broken.	1	2	3	4
5[illegible] Microcomputers are a valuable addition to school resources.	1	2	3	4
5[illegible] Microcomputers promote social interaction.	1	2	3	4
52. For the most part, I teach by posing problems and questioning.	1	2	3	4
5[illegible] Microcomputers are a threat to society.	1	2	3	4
54. I often deviate from the approved textbooks and courses of study.	1	2	3	4
5[illegible] Microcomputers are most helpful in math classes.	1	2	3	4
56. The best use of microcomputers is with small groups after their regular classroom work.	1	2	3	4
57. Students should realize that they must do their work first before they can have fun.	1	2	3	4
58. I would use microcomputers even if the programs didn't quite fit with the topics I was teaching.	1	2	3	4
59. I believe that I would not have time to preview and plan to use microcomputer programs on a regular basis.	1	2	3	4
60. I would use a shared microcomputer much less than I would one regularly in my classroom.	1	2	3	4

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61. There is not enough time to give all students sufficient access to the microcomputers.	1	2	3	4
62. I tend to take a long time to change my classroom habits.	1	2	3	4
63. It is difficult to plan microcomputer use too far in advance.	1	2	3	4

The new items were:

Category- Teaching Style

Item Numbers Added- 4,15*,31,35,48,58,62*

Category- Practical Problems

Item Numbers Added-26*,40*,59*,60,61*,63*

Category- Math versus Language Arts

Item Numbers Added- 41*

Appendix D

ID Number_____

Computer use report

PART ONE

1. Machine used : ______ Apple
   ______ IBM PCjr or Corona
   ______ Commodore 64

2. Machine user: ______ Teacher(If so,omit item 3.)
   ______ Pupil(s)

3. Program used by:
   ______ Whole class(If so,omit item 4.)
   ______ Small group or individual

4. a)Sex of small group or individual users:
   ______ Number of male users
   ______ Number of female users
   b) Ability levels of group or individual users:
   ______ Number of high ability users
   ______ Number of low ability users
   ______ Number of average ability users

5. Name of program used : _____

6. Used during: ______ class time
   ______ outside of class

7. Approximate duration of time used (in minutes): _____

8. Learned about the program from :
   ______ Prof. Small or Haley
   ______ another teacher
   ______ a journal or book
   ______ Provincial Microcomputer Resource Center
   ______ other

9. How the program was obtained:
   ______ by own request
   ______ was already in the school

10. Subject being taught while computer was used:
   ______ language arts
   ______ math
   ______ other subject (Indicate which.)

11. I had to book the computer _____ days in advance to arrange for its use at this time.

12. Location of use : ______ classroom
   ______ library
   ______ resource room
   ______ other

PART TWO (To be completed only if the program was used with pupils.)

1. Was your primary goal for using the computer this time to provide pupils with a computer experience or to teach certain content?

   ------ provide a computer experience
   If so, was the activity used to:
   - ------ reward certain pupils?
   - ------ prepare pupils for later use of computers in school?
   - ------ simply provide an interesting experience?
   - ------ stimulate discussion of computers in language arts, social studies, or math?

   ------ teach content
   If so, was the activity used :
   - ------ to drill and practice?
   - ------ to develop new concepts?
   - ------ to develop new skills?
   - ------ for another purpose?(Please indicate.)

   Was your primary goal:
   - ------ in addition to those normally taught?
   - ------ similar to ones normally taught?
   - ------ identical to ones normally taught?

2. The program met the intended objectives:
   - ------ well.
   - ------ somewhat.
   - ------ not at all.

3. The main problems in using the program were:
   - ------ technical.
     - ------ didn't work at all
     - ------ other technical problems (e.g. dead-end reached, responses unaccepted)
   - ------ with content.
     - ------ content too easy
     - ------ content too difficult
     - ------ instructions unclear
     - ------ boring presentation
   - ------ related to classroom management.
     - ------ Users were distracted.
     - ------ Others in class were disrupted .
   - ------ none
   - ------ other

4. Would you use this again?
   - ------ yes
   - ------ no

5. Would you use it differently next time?
   - ------ yes(How? _____)
   - ------ no

PART THREE (To be completed only if the only user was the teacher.)

1. While examining this program, which were you concentrating on?

   ------ the content of the program
   ------ how to work the disk
   ------ how the computer works

2. Before you looked at this program, did you plan to use it in your class?

   ------ yes
   ------ no

3. Now, do you plan to use it in your class?

   ------ yes
   ------ no

4. If you had planned to use the program before, and on examination decided not to use it, what changed your mind?

   ------ Content was too difficult.
   ------ Content was too easy.
   ------ Concepts were inappropriate for your class.
   ------ Technical quality was poor.
   ------ Content could be better taught without computer .
   ------ management concerns
   ------ other (Please indicate.)

5. If you had not planned to use the program before, and on examination decided you would use it, what changed your mind?

   ------ Graphics were impressive.
   ------ Content was easier to understand than expected.
   ------ Directions were easier to understand than expected.
   ------ Was more entertaining than expected.
   ------ other (Please indicate.)